THE EUCLID CLUB OF THE UNIVERSITY OF WASHINGTON, Seattle, Wash.

[*1919*, 170.]

In November, 1920, the Mathematics Club of the University of Washington was reorganized under the name of the Euclid Club of the University of Washington, and the following officers were elected: Rubin Raport '23, president; Howard Robertson '23, vice-president; Lillie Siler '21, secretary.

The following programs were given:

December 16, 1920: "Einstein's theory of relativity" by Professor E. T. Bell.
January 20, 1921: "Greek numbers" by Helen Dunn '22.
February 3: "The Cyclo-harmonograph, a machine for drawing curves" by Professor R. E. Moritz (the inventor).
February 15: "Who's who in modern mathematics" by Gustene Rupe '23.
March 10: "Modern mathematical machines and famous mathematicians" by Lillie Siler '21.
April 7: "The use of mathematics in science" by Howard Robertson '23.
May 26: "The proof and use of the planimeter" by Rubin Raport '23.

(Report by Mr. Raport.)

NOTES.

Through the courtesy of one of our contributors, Mr. F. V. MORLEY, a Rhodes scholar from the United States at New College, Oxford, we are permitted to inspect the first two numbers of the manuscript *Proceedings of the Oxford University Undergraduate Mathematical Club.* The Club was started in October, 1920, and seven meetings were held during the year. One paper is read at each meeting and the *Proceedings* contain the complete papers. For the Michaelmas Term the papers were: "John Wallis" by J. S. HUGHES, of New College, and "Some circles connected with the triangle" by H. O. NEWBOLT, of Balliol. For the Hilary Term: "Introduction to inversive geometry" (2 parts) by F. V. MORLEY and "The twisted cubic" by Mr. TITCHMARCH, of Balliol. During the Summer Term two meetings were held in May, and Professor FRANK MORLEY, of Johns Hopkins University, and W. R. BURWELL, of Brown University, were the speakers.

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL, OTTO DUNKEL, AND H. P. MANNING.

Send all communications about Problems and Solutions to B. F. FINKEL, Springfield, Mo.

PROBLEMS FOR SOLUTION.

[N.B. Problems containing results believed to be new, or extensions of old results are especially sought. The editorial work would be greatly facilitated if, on sending in problems, proposers would also enclose any solutions or information that will assist the editors in checking the statements. In general, problems in well-known text-books, or results found in readily accessible sources will not be proposed as problems for solution in the MONTHLY. In so far as possible, however, the editors will be glad to assist members of the Association with their difficulties in the solution of such problems.]

2941. Proposed by W. D. CAIRNS, Oberlin College.

$1^2 + 2^2 + 3^2 + \cdots + (n-1)^2$ is a function of n. Find its derivative with respect to n.

2942. Proposed by L. E. DICKSON, University of Chicago.

I am dealt 13 cards at whist. What is the chance that all my cards will be diamonds?

2943. Proposed by L. E. DICKSON, University of Chicago.

In the game of bridge, what is my chance: (*a*) that my hand will contain 4 aces? (*b*) that some hand will contain 4 aces? (*c*) that my hand will be a Yarborough, *i.e.*, contain no honor?

2944. Proposed by S. A. COREY, Des Moines, Iowa.

A particle of mass m, starting from rest, is drawn by a string over a smooth horizontal plane, the other end of the string moving in the plane with uniform acceleration n along a line perpendicular to the initial position of the string. Prove that the tension of the string is $3mn \cos \theta$, where θ is the angle which the string makes with the given line. Also prove that the motion of the particle is vibratory.

2945. Proposed by T. M. BLAKSLEE, Ames, Iowa.

A point P in the plane of the triangle ABC rotates in a given direction around the vertices taken in either cyclical order, in each case through an angle equal to the corresponding angle of the triangle. That is, for example, AP rotates around A through an angle equal to the angle A of the triangle; then BP around B through an angle equal to the angle B, and so on. Prove that P coincides with its original position at the end of six of these rotations. (See problem 2899, *1921*, 228.)

2946. Proposed by H. C. BRADLEY, Massachusetts Institute of Technology.

Cut a regular hexagon into the smallest number of pieces that can be fitted together to form an equilateral triangle: (*a*) no piece to be turned over; (*b*) some pieces may be turned over.

2947. Proposed by D. H. MENZEL, Princeton University.

An oil tank has the shape of a cylinder with ends which are segments of a sphere and with horizontal axis. The diameter of the cylinder being given, and the radius of the spherical segments, derive a formula that will express the volume of the liquid contained in the tank in terms of its depth.

2948. Proposed by J. B. REYNOLDS, Lehigh University.

Find the envelope of the normal planes to the curve,

$$x = a \cos t, \qquad y = a(1 - \cos t), \qquad \text{and} \qquad z = a \sin t.$$

2949. Proposed by J. B. REYNOLDS, Lehigh University.

Find the lateral area of the cone with vertex at $(0, 0, h)$ and whose base is the epicycloid,

$$x = \tfrac{3}{2}a \cos \theta - \tfrac{1}{2}a \cos 3\theta, \qquad y = \tfrac{3}{2}a \sin \theta - \tfrac{1}{2}a \sin 3\theta.$$

2950. Proposed by T. M. SIMPSON, JR., Randolph-Macon College, Ashland, Va.

Determine the curve which cuts the radius vector at an angle proportional to the radius vector.

NOTES.

25. The Area of a Quadrilateral.—The first expression for the area of an inscribed convex quadrilateral, in terms of its sides, was given by Brahmagupta (born 598 A.D.), without proof, in the following form:[1] "The product of half the sides and countersides is the gross area of a triangle and tetragone. Half the sum of the sides set down four times, and severally lessened by the sides, being multiplied together, the square root of the product is the exact area." The latter result appeared in a treatise written by Mahāvīrācārya, about 850 A.D., who gives[2] "The rule for arriving at the minutely accurate measurement of the

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[1] *Algebra with Arithmetic and Mensuration from the Sanscrit of Brahmegupta and Bháscara.* Translated and edited by H. T. Colebrooke, London, 1817, pp. 295–296. See H. Weissenborn "Das Trapez bei Euklid" *Abhandlung zur Geschichte der Mathematik*, Heft 2, Suppl. historisch-literarischen Abtheilung, *Zeitschrift für Math. u. Physik*, vol. 4, 1879, pp. 181–184.

[2] *The Ganita-Sāra-Sangraha of Mahāvīrācārya* with English translations and notes. By M. Raṅgācārya, Madras, 1912, p. 198. Neither Brahmagupta nor Mahāvīrācārya knew that their rule for the exact area of a quadrilateral was only true for cyclic figures. The inexactness of the rule for all quadrilaterals was first pointed out by Bháskara (*l.c.*, § 167) who was born 1114 A.D.